nating in the warmer easterly winds that were then blowing toward Colorado in the rear of the high area that had just passed on to the Lake region. It developed rapidly during that day but subsequently moved northeastward as a long trough and disappeared on the 27th.

XVIII.—This depression suddenly appeared on the afternoon of the 25th in Athabasca and Alberta, while a decided high area was advancing toward Oregon. The low pressure moved rapidly eastward at the northern boundary of our map; brisk and high northwest winds with snow succeeded it in the Lake region; it disappeared on the 29th at the mouth of the Saint Lawrence River.

XIX.—This depression appeared on the afternoon of the 29th north of Assiniboia; it moved southeastward, passing over Manitoba on the morning of the 31st.

XX.—The maps of the 29th–31st show that the high pressure that was moving from the Mississippi Valley eastward was, as in the previous case of low No. XV, attended by northeast winds and rain in southern Florida and the Gulf of Mexico, and, as in that case, so also here, local whirls existing far to the southward could develop into larger storms. On the 29th and 30th this disturbance, which had not yet assumed the form of a large horizontal whirlwind so far as shown by the daily weather map, appeared to the observer at Musquito Lagoon, Oak Hill, Fla., N. 28° 51′, W. 80° 46′, as a distant bank of clouds, which he describes as follows:

> On October 29th a bank of clouds at midnight looked dark and threatening in the distant southeast. This bank moved further away and was due south during the 30th, and disappeared during the 31st in the southwest. The barometer remained high during the whole; the wind was north-northeast on the 29th; northeast on 30th; northeast, force 9, on 31st; and east-northeast, force 5, on November 1st. But little scud accompanied this storm as compared with October 10–14th.

Probably the bank of clouds thus observed in the distant south represents the location of the northern edge of the rain area but not the location of a revolving storm.

NORTH ATLANTIC STORMS FOR OCTOBER, 1893.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The paths of storms that passed over the western portion of the north Atlantic Ocean are shown on Chart I, so far as can be traced from information received up to the 25th of November, through the co-operation of the Hydrographic Office, U. S. Navy, and the "New York Herald Weather Service."

The normal pressure for October over the north Atlantic Ocean, as shown by the international simultaneous meteorological observations, is highest, 30.10 (764), in two large ovals between parallels N. 25° and 40°, and central, respectively, on meridians W. 30° and 85°. The pressure is lowest, 29.70 (754), between Iceland and Greenland. As compared with September the normal pressure for October is about 0.05 less in the North Atlantic between parallels N. 40° and 50°, and meridians W. 30° to 60°.

As compared with the annual normal pressure for the northern hemisphere, the monthly normals for October show a deficiency of 0.05 from Central America eastward over the West Indies to the meridian of 35° W., and between the parallels of 15° to 30° N.

The tracks of storms for October may be classified as (1) those that begin in the Atlantic south of the parallel of 20° and after moving westward turn to the northeast; (2) those that pass from the Pacific coast between parallels 45° and 55° eastward over New England and the Canadian Provinces; (3) those that originate off the New England and Canadian coasts and pass northeastward to Great Britain and Norway. Occasionally one of the first or second class continues long enough to pursue the path followed by the third class, but this is rare.

The region of the greatest frequency of storm-centers extends from Lake Superior to the lower Saint Lawrence, where an average of 5 tracks per month cross over each space of 5° in latitude and longitude during October.

The average velocity of movement of storm-centers for October, in statute miles per hour, is 30 for the United States, when moving eastward, and 19 for the Atlantic Ocean. Before recurving the West Indian storms move at the rate of 12 miles per hour westward, and after recurving at the rate of 28 miles northeastward, but during the recurve at the rate of only 9 miles per hour. The simultaneous charts of the northern hemisphere for 1878 to 1887 show that during the ten years only one storm in the month of October could be traced across both the North American continent and the Atlantic Ocean.

During October, 1893, the following storms have been traced over portions of the north Atlantic Ocean; the centers are located for Greenwich noon by international simultaneous observations, as follows:

A. The center of this storm is located, approximately, on Chart I, for the 29th and 30th of September and for the 1st and 2d of October, as it passed northeastward some distance from the coast of Nova Scotia. The lowest barometer reported was 29.18 on October 1st, but the low pressure filled up by the 4th and the winds died away.

B. This is the continuation of the storm (*F*) in September; it was central in Scotland on the 1st, and extended slowly south and east until, on the 6th, two centers of low pressure and revolving winds existed, the one northeast of Scotland and the other near the Bay of Biscay, both of which continued until the 9th, after which the southern one disappeared and the northern one moved slowly northeastward, disapearing in Finland on October 15th.

C. This represents the end of the history of the incipient hurricane (low area No. III of the United States). This storm, which was a small violent whirl in the Gulf of Mexico on October 1st, passed northeastward over the south Atlantic states, and on October 5th (Greenwich noon) was central at about N. 35°, W. 70°; it appears to have filled up rapidly on the 6th, and it has not been traced any further.

D. This is the Atlantic hurricane (low area No. X of the United States) whose track is given on Chart I as far as our limited knowledge allows. It was evidently a well-developed hurricane on the 5th, moving slowly westward at about N. 15° or 20°; the general depression of which it was a part also included at that time the storms *A* and *C*, and covered the whole West Indies and Caribbean Sea. The storm-center moved steadily westward until it was near the Bahamas on the 12th, it then turned northward and disappeared in Labrador on the 15th.

E. The low area No. VIII of the United States, having its center far north of Canadian stations, moved east-southeast on the 10th, and at noon an extensive area of low pressure, with several subsidiary centers, extended from N. 35°, W. 65° northeastward over Newfoundland; the principal center being near the southern coast of that island. On the 11th, at noon, this was at N. 47°, W. 45°. On the 12th, at noon, N. 50°, W. 42°, barometer 28.85. On the 13th, N. 49°, W. 40°. On the 14th, N. 50°, W. 30°, but stretching northeast as a trough whose other secondary center was about at N. 60°,

W. 20°. On the 15th two centers are recognizable, one in N. 53°, W. 20° and the other in N. 59°, W. 10°, while at the same time a third center was forming in an apparently independent manner at about N. 35°, W. 25°. The northernmost of these three whirls moved northeastward over Scotland and then stretching eastward combined with *B* to form a depression that was central on the 17th over the southern Baltic and on the 18th in western Russia.

F. This is the center just referred to on the 15th near the Azores, it moved over those islands on the 16th, 17th, and 18th in a northwesterly direction, and at noon of the 18th was central about N. 40°, W. 30°, after which it recurved to the north and northeast and disappeared on the 20th.

G. This first appears as a depression north of Scotland on the 18th, and north of Norway on the 19th, after which it moved east and southeast toward eastern Russia, while a high pressure area was central over France, Germany, and Austria.

H. While pressure still remained high in Europe a depression appears on the 21st east of Iceland, which on the 22d is represented by a small depression in southern Sweden and another north of Norway. By noon of the 23d these had developed into a deep low pressure in Lapland, which moved southeastward beyond our maps.

I. The area of highest pressure in central Europe appears on the 23d as the eastward extension of the still higher pressure central west of Ireland at about N. 50°, W. 15°. To the north of this an extensive depression soon developed, which on the 24th may be located at N. 65°, W. 5°. This continued moving southeastward, and on the 26th, at noon, was central in the middle portions of Norway and Sweden. On the 29th, at noon, it was in northern Norway and Sweden, where it is also located on the 30th, at noon, with the subsidiary whirls forming near Ireland and Portugal. On the 31st it had moved southeastward towards eastern Russia.

J. On the 19th pressure seems to have been somewhat low over the Caribbean Sea, while it was quite high over the eastern part of the United States and the adjoining Atlantic Ocean. No reports of whirlwind storms or high winds have as yet been received, but a complete system of cyclonic winds existed over the Caribbean Sea, whose center on the 20th was approximately at N. 18° and W. 82°. On the 21st it was at N. 24°, W. 78°; on the 22d, at noon, the wind circulated about a center at N. 30°, W. 79°, and at this time begins a definite history of United States storm XV, which broke up on the 23d in Maryland.

OCEAN ICE IN OCTOBER.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for October during the last 11 years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
October, 1883	46 56	46 22	October, 1883	46 56	42 22
October, 1884	Off Cape	Race.	October, 1884	46 56	50 55
October, 1885	48 21	47 12	October, 1885	48 21	47 12
October, 1886	41 34	49 43	October, 1886	46 03	46 37
October, 1887	42 58	50 02	October, 1887	42 58	50 02
October, 1888	51 43	55 36	October, 1888	51 43	55 36
October, 1889	44 32	49 26	October, 1889	46 30	45 59
October, 1890	44 47	49 33	October, 1890	47 56	45 45
October, 1891	48 04	48 27	October, 1891	48 04	48 27
October, 1892	Straits of	Belle Isle	October, 1892	52 34	51 00
October, 1893	49 57	59 32	October, 1893	52 47	51 16
Mean	46 32	50 39	Mean	48 15	48 41

Ice was reported south of the 50th parallel only on two dates, 8th and 11th. In an area extending from the Straits of Belle Isle to the 51st meridian ice was reported on the 1st to the 4th, 7th, 8th, 10th, 11th, 13th to 15th, 17th, 22d, 26th, 28th to 31st. The southern limit of ice was about 3½° north and the eastern limit was about 2½° west of the average southern and eastern limits of ice for October. The region within which icebergs or field ice were reported for the current month is shown on Chart I by crosses (×).

OCEAN FOG IN OCTOBER.

The limits of fog belts west of the 40th meridian, as determined by reports of shipmasters, are shown on Chart I by dotted shading. Near the Grand Banks of Newfoundland fog was reported on 19 dates; between the 55th and 65th meridians, on 12 dates; and west of the 65th meridian, on 6 dates. Compared with the corresponding month of the last 6 years the dates of occurrence of fog near the Grand Banks numbered 5 more than the average; between the 55th and 65th meridians, 8 more than the average; and west of the 65th meridian, 3 more than the average.

TEMPERATURE OF THE AIR (expressed in degrees Fahrenheit).

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are, however, not drawn for the higher irregular surface of the Rocky Mountain plateau; the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country over which they are drawn; in mountainous regions such isotherms would be controlled largely by the topography, and it is, therefore, not practicable to present the temperature data in this manner unless a contour map on a large scale is published as a base chart.

In the table of meteorological data from voluntary observers the actual mean temperature is given for each station, and in the tables of climatological data for the regular stations of the Weather Bureau both the mean temperatures and the departures from the normal are given. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal. The normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

For regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to the table of meteorological data.

During October, 1893, the mean temperature was highest at a few stations in the extreme southern portion of Florida and in the Colorado Valley, the average being between 75 and 80. The temperature averaged between 50 and 55 on the immediate coast of Washington, Oregon, and California north of the 35th parallel; corresponding mean temperatures occurred on the Atlantic coast from Cape Breton to Long Island Sound. The average temperature was below 32 in central Manitoba and Saskatchewan.

DEPARTURES FROM NORMAL TEMPERATURE.

As compared with the normal for this month the mean temperature for October, 1893, was in excess over the lower Missouri and upper Mississippi valleys, the Lake region, the Middle States, New England, and the Canadian Maritime Provinces; the maximum excess was from 4 to 7 in the lower Saint Lawrence valley, New Brunswick, and Cape Breton.